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GEOMAGNETIC ACTIVITY DURING THE PREVIOUS DAY IS CORRELATED WITH INCREASED CONSUMPTION OF SUCROSE DURING SUBSEQUENT DAYS: IS INCREASED GEOMAGNETIC ACTIVITY AVERSIVE?[1]

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Summary.—In five separate blocks over a period of several months for 33 female rats the amount of geomagnetic activity during the day before *ad libitum* access to 10% sucrose or water was positively correlated with the volume of sucrose consumed per 24-hr. period. The strength of the correlation (.62 to .77) declined over the subsequent 10 days from between .12 to −.18 and resembled an extinction curve. In a subsequent experiment four rats exposed to 5 nT to 8 nT, 0.5-Hz magnetic fields that ceased for 30 min. once every 4 hr. for 4 days consumed 11% more sucrose than the four rats exposed to no field. We suggest that the initial consumption of 10% sucrose may have been reinforced because it diminished the aversive physiological effects associated with the increased geomagnetic activity. However, over the subsequent days, as geomagnetic activity decreased or habituation occurred, negative reinforcement did not maintain this behavior.

Galic and Persinger (2002) found that female rats, when allowed free access to either water or 10% sucrose, consumed 150 to 200 cc of sugar water per day for weeks even though their typical daily intake of fluids (water) was between 25 and 30 cc. Many of the behaviours of the female rats resembled those exhibited by addicted humans. Persinger (2004) suggested that increases in geomagnetic activity result in "negative" physiological states that contribute to affectively related behaviors such as aggression, disruptions in attention (hence increased traffic, industrial, and aviation accidents), and sleep disturbances.

If increased geomagnetic activity induces a negative hedonistic state within some animals and the consumption of sucrose reduces this state, then there should be strong positive correlations between increased geomagnetic activity and the amounts of sucrose consumed. The relationship between sucrose consumption and geomagnetic activity should reflect the principle of negative reinforcement, with the geophysical stimulus being the aversive stimulus and the consumption of sucrose being the response that attenuates the magnitude of the consequences of this stimulus.

In five replicates or blocks starting on different days over a 5-mo.

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period 33 4-mo.-old Wistar albino female rats (3 to 8 per block) were given continuous access to two 250-cc bottles containing water or 10% sucrose. The rats were housed singly in plastic shoebox cages containing 1/4-in. corncob bedding. Purina rat chow was available *ad libitum*. The amounts of water and sucrose-water consumed were measured daily and refreshed. Direct measurements of geomagnetic activity by a MEDA FM 300 magnetometer within the cages were correlated more than .90 with various indices of global daily geomagnetic activity, obtained from Geomagnetic Indices Bulletin (Boulder).[2]

The averages of the maximum and minimum A values for each of the three days before, the day of, and for each of the three days after the beginning of each block were correlated (using Spearman *rho* because the sample was small) with the mean values of the sucrose consumed during the first 10 days of the block. The strongest correlation ($r = .72$) occurred between the geomagnetic activity the day before the block began and the amount of sucrose consumed on the first and second days of the block. Regression analysis indicated about 100 cc of the consumption was associated with the range of average daily global activity between 12 nT and 62 nT.

The strengths of the Spearman *rho* correlations between the geomagnetic activities during the day before the blocks began and the amounts of sucrose consumed during subsequent days declined conspicuously. These values for Days 1 through 12 were .62, .77, .52, .52, .51, .43, .40, .25, .35, .12, .30, and −.08, respectively. The means and standard deviations for the average planetary A indices of the day before the beginning of the block were 18.4 and 6.2. These values for the first four days of the blocks were 19.2 ($SD = 11.7$), 18.0 ($SD = 8.9$), 15.6 ($SD = 6.2$), and 19.0 ($SD = 7.1$), respectively.

To discern whether results could be simulated experimentally four female rats were exposed during a quiet (geomagnetic) period to a 0.5-Hz, 5- to 8-nT magnetic field that was disrupted for 30 min. every 4 hr. for four days while four other female rats were exposed to a control coil (see Dupont, McKay, Parker, & Persinger, 2004). Our prediction that sucrose consumption would increase in the group exposed to the geomagnetic-simulated field compared to change for the control animals was supported ($F_{1,6} = 4.28$, $p < .05$; one-tailed, $\eta = .65$). They drank about 14 cc more sucrose per day than the control group. Group differences for the subsequent four days of sucrose consumption were not statistically significant ($F_{1,6} = 2.35$, $p > .05$).

We interpret both sets of results as supportive of the hypothesis that increased geomagnetic activity induces a negative hedonistic state. Any re-

[2]www.dxlc.com/solar/indices.html.

sponse that reduces this negative condition will be maintained (negative reinforcement). Because the strength of the association between daily sucrose consumptions after the first day of consumption (novelty) and the geomagnetic activity the day before the first consumption declined during subsequent days, either this hypothesized physiological state was no longer aversive or the effectiveness of sucrose consumption for attenuating this aversive state may have declined ("tolerance").

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